Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the present application.

Listing of Claims:

1. (Currently Amended) A method of controlling auto-ignition timing in an internal combustion engine cylinder that is coupled to at least one prechamber, the method comprising:

precisely controlling a timing of auto-ignition in the at least one prechamber, the auto-ignition in the at least one prechamber producing hot gas jets;

inducing auto-ignition in the cylinder by introducing the hot gas jets from the at least one prechamber into the cylinder; and

enriching a fuel-air mixture in the at least one prechamber to a rich level;

wherein the auto-ignition in the at least one prechamber is induced by a pressure increase within the at least one prechamber with built-up pressure from the cylinder.

2. (Original) The method of claim 1, wherein each prechamber is coupled to the cylinder by at least one microvalve and each prechamber encloses a volume that is substantially smaller than a volume enclosed by the cylinder.

3. (Original) The method of claim 2, wherein the step of precisely controlling a time of auto-ignition in the at least one prechamber comprises:

setting conditions in the at least one prechamber so as to cross a threshold for auto-ignition during precisely controlled time interval while conditions in the cylinder remain below the threshold for auto-ignition.

4. (Canceled)

5. (Previously Presented) The method of claim 1, wherein the fuel-air mixture is enriched to an equivalence ratio of greater than 1.1.

6. (Original) The method of claim 3, further comprising:

boosting a temperature within the at least one prechamber.

7. (Original) The method of claim 6, wherein the temperature within the at least one prechamber is boosted to over 1000 degrees Kelvin (K).

8. (Original) The method of claim 3, further comprising:

injecting additives to the at least one prechamber suitable for facilitating auto-ignition in the at least one prechamber.

9. (Original) The method of claim 3, further comprising:

coating walls of the at least one prechamber with a catalyst suitable for facilitating auto-ignition in the at least one prechamber.

10. (Original) The method of claim 3, further comprising:

during a first stage of a compression stroke of a piston in the cylinder, opening the at least one microvalve of least one prechamber to bring the pressure within the at least one prechamber to a pressure level within the cylinder;

during a selected time interval in an intermediate stage of the compression stroke, closing the at least one microvalve of the at least one prechamber; and

at a subsequent stage of the compression stroke, opening the at least one prechamber microvalve, bringing the at least one prechamber to auto-ignition after a short time delay.

11. (Original) The method of claim 10, further comprising:

adding fresh charge to the at least one prechamber to reach an elevated equivalence ratio with respect to the cylinder.

12. (Original) The method of claim 10, wherein the short time delay is approximately 1 millisecond (1 ms) in duration.

13. (Original) The method of claim 10, further comprising:

determining, based on the requested load demand and current operating parameters in the cylinder, an optimum time to open the at least one microvalve to induce prechamber auto-ignition.

14. (Original) The method of claim 13, wherein the optimum time occurs when the piston is close to a top dead center (TDC) position.

15. (Currently Amended) A system for homogeneous combustion jet ignition in an internal combustion engine cylinder comprising:

at least one prechamber coupled to the cylinder via at least one microvalve; and

an electronic control unit, the electronic unit receiving data regarding requested load demand and current operating parameters within the cylinder, the electronic control unit configured to control the at least one microvalve based on the received data so as to induce an auto-ignition within the at least one prechamber, the auto-ignition being induced by an increase in pressure within the at least one prechamber with built-up pressure from the cylinder; and

intake means for delivering fuel, air and additives to the at least one prechamber;

wherein a fuel-air mixture within the at least one prechamber is enriched via the intake means.

16. (Original) The system of claim 15, wherein the at least one prechamber is situated near the top of the cylinder and encloses a volume that is substantially smaller than a volume enclosed by the cylinder.

17. (Original) The system of claim 16, wherein the electronic control unit precisely controls at least one microvalve of at least one of the at least one prechamber to:
remain open at the beginning of a compression stroke in the cylinder;

(b) close during an immediate stage of the compression stroke; and

(c) open subsequently near a top-dead-center (TDC) position;

wherein auto-ignition occurs within the at least one prechamber after a short ignition delay time after operation (c).

18. (Canceled)

19. (Canceled)

20. (Previously Presented) The system of claim 16, wherein additives are supplied to the at least one prechamber via the intake means.

21. (Original) The system of claim 16, further comprising:

catalyst coating applied to internal walls of the at least one prechamber.

22. (Original) The system of claim 16, further comprising:

means for boosting temperature within the at least one prechamber.

23. (Original) The system of claim 15, wherein the at least one microvalve includes an actuator coupled to a needle, the actuator causing the needle to shift, the shift of the needle opening or closing an orifice in the prechamber that leads to the cylinder

24. (Original) The system of claim 15, wherein the actuator comprises a magnetic solenoid and coil.

25. (Original) The system of claim 15, wherein the actuator comprises a piezoelectric stack.